REMARKS

Reconsideration of the issues raised in the above referenced Office Action is respectfully solicited.

Applicants appreciate the approval of the formal drawing sheet including Figures 5 and 6.

Claim 3 has been amended to address a typographical informality therein. Claim 8 has been amended to incorporate the features of cancelled Claim 9 dependent therefrom. Thus Claim 8 now more narrowly recites the properties of the alloy plate as set forth in cancelled Claim 9. Therefore no new issues are presented.

Claims 10-12 have been amended to depend from Claim 8 instead of cancelled Claim 9. Further, Claim 10 has been amended to recite the abbreviation NBR in unabbreviated form. Claims 4-7, 13 and 14 have been cancelled to reduce the number of issues.

The rejection of Claims 1-14 under 35 USC §112, second paragraph, as indefinite has been considered.

Claims 1, 3 and 9 are rejected for reciting various JIS aluminum alloy plates. The rejection indicates that the listing of JIS (Japanese Industrial Standard) alloys is improper for not particularly pointing out and distinctly claiming the subject matter. This rejection is respectfully traversed.

JIS alloys are clearly defined and known to one of ordinary skill in the art. Attached is an English language copy of JIS standards including JIS numbers for aluminum alloys. Due to the large number of pages listing JIS standards, only selected pages 989-994 are provided. The JIS standards provide properties of aluminum and various aluminum alloys of sheets, plates, and strips for corresponding JIS numbers.

Table 1 at pages 991-993 discusses the grade, the class and symbols for the various aluminum alloy numbers and the characteristics and purposes thereof. Table 2 at pages 994-995 provides a listing of chemical compositions for the

corresponding aluminum alloy JIS numbers. One of ordinary skill in the art clearly can determine from the tables and JIS standards, the properties and the composition of the numbered JIS aluminum alloys. Therefore the claimed aluminum alloys are clearly described and understandable to one of ordinary skill in the art.

Further, USPTO patents including claims utilizing JIS numbers are not uncommon. For example, the claims in U.S. Patent Nos. 6 186 478; 6 481 690; 6 527 491 and 6 548 191 recite specific aluminum alloys as defined by their JIS numbers. Thus claiming aluminum alloys defined by JIS numbers is acceptable at the USPTO.

The Office Action states that abbreviation "NBR" in Claim 10 needs to be spelled out. In Claim 10, "NBR" has been rewritten as ---nitrile-butadiene rubber---. The attached glossary page from "Tyco Electronics Connectors" shows that "NBR" is a common abbreviation for nitrile-butadiene rubber. The specification has also been amended to provide the term in unabbreviated form.

The rejection of Claims 5, 6 and 13 as being indefinite is removed by the canceling of these claims.

Claim 8 was rejected for comparing the aluminum alloy plate with an aluminum plate. In order to address the rejection, Applicants have amended Claim 8 to recite the specific aluminum alloy plates set forth in cancelled dependent Claim 9. Incorporating the limitations from Claim 9 narrows the scope of Claim 8 and more clearly defines the invention.

For the above reasons, reconsideration and withdrawal of the rejection of Claims 1-3, 8 and 10-12 as being indefinite under 35 USC §112, second paragraph, is respectfully requested.

The rejection of Claim 1 under 35 USC §102(b) as being anticipated by Rath, GB 1 498 007 has been considered.

Rath discloses a disc brake including a caliper and a strip that comprises a shim between the brake pad and the

hydraulic piston. The strip for the shim of Rath is disclosed as "aluminum", but various other metals or alloys may be employed.

Rath is directed to preventing squeal of disc brakes. There is no disclosure or suggestion of preventing corrosion of an aluminum caliper. There is no disclosure of the type of material utilized for the caliper.

Applicants' claimed invention provides an anti-squeal shim structure that is formed by an aluminum alloy plate.

Applicants' Claim 1 recites "an aluminum alloy plate having a compressive strength and heat resistance as in JIS 1085, 1080, 1070, 1050, 1100, 1200, IN00, IN30, 2014, 2017, 2219, 2024, 3003, 3203, 3004, 3104, 3005, 3105, 5005, 5052, 5652, 5154, 5254, 5454, 5082, 5182, 5083, 5086, 5N01, 6061, 7075 or 7N01". These alloys have the necessary heat resistance and compressive strength to function properly as a metal plate in a shim structure.

The rejection relies on the sentence provided at page 1, lines 81-83 of Rath which recites "A suitable material for the strip is aluminum, but various other metals or alloys may be employed." This phrase is non-specific as to the other types of materials that could be used. Further, the preferred suitable material disclosed by Rath is aluminum.

Paragraph [0018] of Applicants' specification indicates that an aluminum plate does not function well as a shim due to its poor heat resistance and compressive strength. This problem is not recognized by Rath. Thus, one of ordinary skill in the art would not have been motivated to select the specific alloys having the compressive strength and heat resistance as recited in Applicants' Claim 1.

As set forth in Applicants' paragraphs [0036] through [0041] and as illustrated in Tables 1 and 2 of Applicants' specification, Applicants' invention provides a significant improvement in minimizing squeal generation and in minimizing corrosion. Rath does not disclose the problem of corrosion,

much less the physical properties of a shim necessary to prevent such corrosion.

For the above reasons, reconsideration and allowance of Claim 1 is respectfully requested.

The rejection of Claim 2 under 35 USC §103 as being unpatentable over Rath in view of Applicants' admitted prior art disclosed at paragraph [0004] of Applicants' specification has been considered. Applicants admit that the use of an aluminum caliper instead of a steel caliper for automobile brake parts is known.

Applicants' Claim 2, however, recites the combination of a shim structure comprising "an aluminum alloy plate", along with "an aluminum caliper". As discussed above, Rath does not disclose an aluminum caliper. Even if a known aluminum caliper were provided for use with the shim structure of Rath, which Applicants' disagree with, there is no motivation to provide an aluminum alloy shim structure. Rath instead would provide an aluminum caliper and an aluminum shim structure.

Applicants' Claim 2 further recites that "the aluminum alloy plate has little difference in electrode potential than the aluminum caliper so that corrosion due to a difference in electrode potential is minimized". The specific combination of an aluminum caliper with an aluminum alloy plate is not disclosed in the applied prior art, much less disclosed to minimize corrosion.

For the above reasons, reconsideration and allowance of independent Claim 2, and Claim 3 dependent therefrom, is respectfully requested.

Applicants' Claim 3 further distinguishes the applied prior art. Claim 3 recites that the aluminum alloy plate has a compressive strength and heat resistance as in JIS 1085, 1080, 1070 … 7075 or 7N01. Rath and the admitted prior art do not disclose or suggest the specific compressive strengths and the heat resistances of the JIS alloys recited in Claim 3. Therefore, reconsideration and allowance of Claim 3 is respectfully requested.

The rejection of Claim 8 under 35 USC §103 as being unpatentable over Rath in view of the admitted prior art in paragraph [0004] of Applicants' specification has been considered.

Amended independent Claim 8 recites a disc brake apparatus including "an aluminum caliper", "a disc brake pad", and "an anti-squeal shim structure comprising: an aluminum alloy plate, said aluminum alloy plate having a compressive strength and heat resistance as in JIS 1085, 1080, 1070, 1050, 1100, 1200, IN00, IN30, 2014, 2017, 2219, 2024, 3003, 3203, 3004, 3104, 3005, 3105, 5005, 5052, 5652, 5154, 5254, 5454, 5082, 5182, 5083, 5086, 5N01, 6061, 7075 or 7N01", a "piston", and a disc rotor. As discussed above, Rath discloses the preferred use of an aluminum plate which does not have the required heat resistance and compressive strength as recited in Applicants' Claim 8.

Claim 8 further recites that "the aluminum alloy plate of said anti-squeal shim structure and said aluminum caliper have little difference in electrode potential so that corrosion of said caliper due to a difference in electrode potential is minimized".

As discussed above, the applied prior art does not disclose or suggest the prevention of corrosion, much less providing the proper aluminum alloy plate in combination with an aluminum caliper to have little difference in electrode potential.

For the above reasons independent Claim 8, and Claims 10-12 dependent therefrom, distinguish the applied prior art. Claims 10-12 are allowable for the reasons discussed above with respect to Claim 8.

For the above reasons, reconsideration and allowance of Claims 1-3, 8 and 10-12 is respectfully requested.

COMMENT

The rejection of Claim 1 states that Rath discloses an "aluminum alloy" plate 2. As discussed above, the phrase "aluminum alloy" does <u>not appear</u> in Rath. Rath merely

discloses using aluminum for the strip, and that "various other metals or alloys may be employed" (emphasis added). There is no suggestion in Rath that such various other metals or alloys are specifically an aluminum alloy plate.

The rejection infers that the broad teaching of metals and alloys encompasses Applicants claimed invention.

There are more than thousands of alloys. The attached document from "Nickel-stainless steel world" states that nickel is used in thousands of alloys. Further, the attached article "Iron-the second most unusual substance on earth" discloses that iron forms literally thousands of alloys. Further, it is well known that alloys have different properties.

The mere idea that a reference may encompass a large number of possible materials does not necessarily mean that the use of an encompassed material would have been obvious (See *In re Baird*, 29 USPQ2d 1550).

Applicants' claimed series of aluminum alloy plates have specific beneficial properties as discussed above. Rath discloses aluminum as a suitable material. Aluminum does not function well as discussed in Applicant's specification at paragraph [0018]. Thus Rath teaches away from Applicants claimed invention.

Per *Baird*, the mere fact that an alloy may be encompassed in a broad disclosure, which Applicant's do not admit herein, does not result in the reference teaching the specific alloys when there are a huge number of possible alloys.

Rath does not specify "aluminum alloys", but instead "metals" and "alloys". As discussed above, there are more than thousands of alloys made with nickel, iron, aluminum and other combinations of metals. Thus Rath does not fairly teach the specific series of aluminum alloys recited in Applicants' Claims 1, 3 and 8, which reduce or eliminate corrosion while having the required heat resistance and compressive strength. Therefore, Claims 1, 3 and 9 further distinguish Rath either

alone or in combination with the admitted prior art of paragraph [0004] of Applicants' specification.

Further and favorable reconsideration is respectfully solicited.

Respectfully submitted,

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Encl: English language version of JIS Chemical Composition Table, "Aluminum and aluminum alloy sheets and plates, strips and coiled sheets" pp. 989-995
Glossary N-connectors.tycoelectronics.com (single page)
"Iron-the second most unusual substance on earth" www.physics.uwo.ca (2 pages)
"Nickel-stainless steel world" www.stainless-steel-world.net (2 pages)
Postal Card

136.07/05

Aluminium and aluminium alloy sheets and plates, strips and coiled sheets

Introduction This Japanese Industrial Standard specifies, in the text of the Standard, the grades and their qualities and dimensions, which have been specified in former JIS, based on the International Standards given in clause 1, Remarks 1, and in the Annex to this Standard, the technical contents given in the corresponding International Standards without changing.

1 Scope This Japanese Industrial Standard specifies rolled aluminium and aluminium alloy sheet and plate, clad sheet and plate, strip and disk, hereafter referred to as "plate", "clad plate", "strip" and "disk".

Remarks 1 International Standards corresponding to this Standard are shown as follows.

ISO 209-1 : 1989 *Wrought aluminium and aluminium alloys—Chemical composition and forms of products—Part 1 : Chemical composition*

ISO 209-2 : 1989 *Wrought aluminium and aluminium alloys—Chemical composition and forms of products—Part 2 : Forms of products*

ISO 6361-1 : 1986 *Wrought aluminium and aluminium alloys sheets, strips and plates—Part 1 : Technical conditions for inspection and delivery*

ISO 6361-2 : 1990 *Wrought aluminium and aluminium alloy sheets, strips and plates—Part 2 : Mechanical properties*

ISO 6361-3 : 1985 *Wrought aluminium and aluminium alloy sheets, strips and plates—Part 3 : Strips—Tolerances on shape and dimensions*

ISO 6361-4 : 1988 *Wrought aluminium and aluminium alloy sheets, strips and plates—Part 4 : Sheets and plates—Tolerances on shape and dimensions*

2 The Annex 1 may be applied instead of the Standard text only when requested by the purchaser.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS H 0001 *Aluminium, magnesium and their alloys—Temper designation*

JIS H 0321 *General rules for inspection of non-ferrous metal materials*

JIS H 1305 *Method for photoelectric emission spectrochemical analysis of aluminium and aluminium alloy*

JIS H 1306 *Methods for atomic absorption spectrometric analysis of aluminium and aluminium alloys*

JIS H 1307 *Methods for inductively coupled plasma emission spectrometric analysis of aluminium and aluminium alloys*

JIS H 1352 *Methods for determination of silicon in aluminium and aluminium alloys*

JIS H 1353 *Methods for determination of iron in aluminium and aluminium alloys*

JIS H 1354 *Methods for determination of copper in aluminium and aluminium alloys*

JIS H 1355 *Methods for determination of manganese in aluminium and aluminium alloys*

JIS H 1356 *Methods for determination of zinc in aluminium and aluminium alloy*

JIS H 1357 *Methods for determination of magnesium in aluminium and aluminium alloy*

JIS H 1358 *Methods for determination of chromium in aluminium and aluminium alloys*

JIS H 1359 *Methods for determination of titanium in aluminium and aluminium alloys*

JIS H 1362 *Method for determination of vanadium in aluminium and aluminium alloys*

JIS H 1363 *Methods for determination of zirconium in aluminium alloy*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2204 *Bend test pieces for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 2248 *Method of bend test for metallic materials*

3 Definitions For main terms used in this Standard, the following definitions apply.

a) **clad plate** A plate which is clad on all the surface of the base material (a plate constituting the base plate) with a sheet of a different kind alloy by a method such as pressure welding or the like.

b) **plate** A rolled material of a rectangular cross-section having a thickness at least 0.15 mm, supplied in straight lengths usually with slit, sheared or sawn edges.

Remarks : A thick plate refers to a plate having over 6 mm thickness, and the plate mentioned in this Standard sometimes includes the thick plate.

c) **strip** A rolled product of rectangular cross-section with a thickness at least 0.15 mm, supplied in coils usually with slit edges.

d) **disk** A disk-like plate that a plate or a strip is generally cut by pressing or cut by shearing.

4 Grade, class and symbol The grade, class and symbol shall be as shown in Table 1.

Table 1 Grade, class and symbol

Grade Alloy No.	Class	Symbol	Informative reference Characteristics and examples of application
1085	—	A1085P	Being pure aluminium, low strength but excellent in formability, weldability and corrosion resistance. For reflection plates, lighting fixtures, ornaments, tanks for chemical industry, conductive materials and so on.
1080	—	A1080P	
1070	—	A1070P	
1050	—	A1050P	
1100	—	A1100P	Relatively low strength but excellent in formability, weldability and corrosion resistance. For general vessels, architectural materials, electric appliances, various containers, printing boards and so on.
1200	—	A1200P	
1N00	—	A1N00P	Slightly higher strength and superior formability than that of 1100. For daily necessaries and the like.
1N30	—	A1N30P	Excellent ductility and corrosion resistance. For aluminium foil and others.
2014	—	A2014P	A high strength heat-treated alloy. In the case of clad plate, 6003 is laminated on the surface of the plate to improve corrosion resistance. For materials for airplanes, various construction materials and so on.
	—	A2014PC	
2017	—	A2017P	Heat-treated alloy. High strength and good machinability. For materials for airplanes, various construction materials and so on.
2219	—	A2219P	High strength and excellent in heat resistance and weldability. For equipments of aircrafts and spacecrafts and so on.
2024	—	A2024P	Higher strength than that of 2017 and excellent in machinability. Clad plate has improved corrosion resistance by laminating 1230 on the surface of the plate. For materials for airplane, various construction materials and others.
	—	A2024PC	
3003	—	A3003P	Slightly higher strength than that of 1100 and excellent in formability, weldability and corrosion resistance. For general vessels, architectural materials, materials for ships, materials for fins, various containers and so on.
3203	—	A3203P	
3004	—	A3004P	Higher strength than that of 3003, excellent in formability and good in corrosion resistance. For cans for beverage, roofplates, materials for door panels, colored aluminium, lamp socket, and so on.
3104	—	A3104P	
3005	—	A3005P	Higher strength than that of 3003, excellent in corrosion resistance. For architectural materials, colored aluminium and others.

Table 1 (continued)

Grade Alloy No.	Class	Symbol	Informative reference Characteristics and examples of application
3105	—	A3105P	Slightly higher strength than that of 3003, excellent in formability and corrosion resistance. For architectural materials, colored aluminium, caps and so on.
5005	—	A5005P	Equivalent in strength to 3003, excellent in corrosion resistance, weldability and machinability. For exterior and interior materials of buildings, interior materials of wagons and the like.
5052	—	A5052P	A representative alloy having a medium strength. Excellent in corrosion resistance, formability, and weldability. For materials for ships, vehicles, buildings, cans for beverages, and so on.
5652	—	A5652P	An alloy which is restrained decomposition of hydrogen peroxide by limiting the content of impurities of 5052, the other characteristics being the same as those of 5052. For hydrogen peroxide vessels and others.
5154	—	A5154P	An alloy having a strength between those of 5052 and 5083. Excellent in corrosion resistance, formability and weldability. For materials for ships and vehicles, pressure vessels and the like.
5254	—	A5254P	An alloy which is restrained from decomposing hydrogen peroxide by limiting the content of impurities of 5154, for other characteristics, the same as those of 5154. For hydrogen peroxide vessels and others.
5454	—	A5454P	Higher strength than that of 5052, excellent in corrosion resistance, formability and weldability. For automobile wheels and the like.
5082	—	A5082P	Almost the same strength as 5083, excellent in formability and corrosion resistance. For cans for beverages and the like.
5182	—	A5182P	
5083	Ordinary class	A5083P	An alloy having the highest strength among non-heat-treated alloys. Excellent in corrosion resistance and weldability. For materials for ships and vehicles, low-temperature tanks, pressure vessels and so on.
	Special class	A5083PS	
5086	—	A5086P	A welding structural alloy with higher strength than that of 5154 and excellent corrosion resistance. For materials for ships, pressure vessels, magnetic disks and others.
5N01	—	A5N01P	Almost the same strength as 3003. A high brightness can be obtained by bright processing such as chemical or electrolytic polishing followed by anodic oxidation processing. Excellent in formability and corrosion resistance. For ornaments, kitchen utensils, name plate and the like.

Table 1 (concluded)

Grade Alloy No.	Class	Symbol	Informative reference Characteristics and examples of application
6061	—	A6061P	Excellent in corrosion resistance. Mainly used as structural materials for rivet jointing. For ships, vehicles, ground constructions and others.
7075	—	A7075P	An alloy having the highest strength among aluminium alloys. Clad plate is a plate which is laminated 7072 on the surface to improve the corrosion resistance. For materials of airplanes, skis and others.
	—	A7075PC	
7N01	—	A7N01P	A welding structural alloy having high strength and good corrosion resistance. For vehicles, ground constructions and others.
8021	—	A8021P	Higher strength than that of 1N30, excellent in spreading property and corrosion resistance. For aluminium foil and others. For decoration, telecommunication, packaging and the like.
8079	—	A8079P	

Remarks 1 The symbol denoting the temper grade shall be suffixed to the symbol of grade mentioned above.

2 The utilization of A2014PC, A2024PC and A7075PC shall be limited to a clad plate.

3 The utilization of A5083PS shall be limited only to a side wall plate, annular plate and nuckle plate of storage tank for liquefied natural gas.

5 Quality

5.1 Appearance The plate, clad plate, strip and disk shall show fine quality of finish, be uniformly and be free from defects such as blisters and flaws detrimental to practical use. The surface defects shall be smoothly removed, and the product shall be within dimensional tolerances.

5.2 Chemical composition The chemical composition of the plate, clad plate (core material and skin material), strip and disk shall be as given in Table 2.

5.3 Mechanical property The mechanical properties (tensile strength, proof stress, elongation and bending property) of the plate, strip, disk and clad plate shall be as given in Tables 3.1 and 3.2. For a strip and disk, however, above-mentioned tables shall be applied to those of 4.5 mm and under and 3.5 mm and under in thickness, respectively. In the bending test given in 7.3, of the plate, strip and clad plate, the test piece shall exhibit no cracking on the outside of the bent portion.

However, bend test and proof stress for 1085, 1080, 1070, 1050, 1100, 1200, 1N00, 1N30, 3003, 3203, 3004, 3104, 3005, 3105, 5005, 5052 and 5N01 shall be applied only when requested by the purchaser.

Table 2 Chemical composition

Unit : %

Alloy No.	Skin and base material	Si	Fe	Cu	Mn	Mg	Cr	Zn	Zr, Zr+Ti, Ga, V	Ti	Others([1]) Each	Others([1]) Total	Al
1085	—	0.10 max.	0.12 max.	0.03 max.	0.02 max.	0.02 max.	—	0.03 max.	Ga 0.03 max., V 0.05 max.	0.02 max.	0.01 max.	—	99.85 min.
1080	—	0.15 max.	0.15 max.	0.03 max.	0.02 max.	0.02 max.	—	0.03 max.	Ga 0.03 max., V 0.05 max.	0.03 max.	0.02 max.	—	99.80 min.
1070	—	0.20 max.	0.25 max.	0.04 max.	0.03 max.	0.03 max.	—	0.04 max.	V 0.05 max.	0.03 max.	0.03 max.	—	99.70 min.
1050	—	0.25 max.	0.40 max.	0.05 max.	0.05 max.	0.05 max.	—	0.05 max.	V 0.05 max.	0.03 max.	0.03 max.	—	99.50 min.
1100	—	Si+Fe 0.95 max.		0.05 to 0.20	0.05 max.	—	—	0.10 max.	—	—	0.05 max.	0.15 max.	99.00 min.
1200	—	Si+Fe 1.00 max.		0.05 max.	0.05 max.	—	—	0.10 max.	—	0.05 max.	0.05 max.	0.15 max.	99.00 min.
1N00	—	Si+Fe 1.0 max.		0.05 to 0.20	0.05 max.	0.10 max.	—	0.10 max.	—	0.10 max.	0.05 max.	0.15 max.	99.00 min.
1N30	—	Si+Fe 0.7 max.		0.10 max.	0.05 max.	0.05 max.	—	0.05 max.	—	—	0.03 max.	—	99.30 min.
2014	—	0.50 to 1.2	0.7 max.	3.9 to 5.0	0.40 to 1.2	0.20 to 0.8	0.10 max.	0.25 max.	Zr+Ti 0.20 max.	0.15 max.	0.05 max.	0.15 max.	Remainder
2014 Clad plate	Base material	0.50 to 1.2	0.7 max.	3.9 to 5.0	0.40 to 1.2	0.20 to 0.8	0.10 max.	0.25 max.	Zr+Ti 0.20 max.	0.15 max.	0.05 max.	0.15 max.	Remainder
	Skin material (6003)	0.35 to 1.0	0.6 max.	0.10 max.	0.8 max.	0.8 to 1.5	0.35 max.	0.20 max.	—	0.10 max.	0.05 max.	0.15 max.	Remainder
2017	—	0.20 to 0.8	0.7 max.	3.5 to 4.5	0.40 to 1.0	0.40 to 0.8	0.10 max.	0.25 max.	Zr+Ti 0.20 max.	0.15 max.	0.05 max.	0.15 max.	Remainder
2219	—	0.20 max.	0.30 max.	5.8 to 6.8	0.20 to 0.40	0.02 max.	—	0.10 max.	V 0.05 to 0.15, Zr 0.10 to 0.25	0.02 to 0.10	0.05 max.	0.15 max.	Remainder
2024	—	0.50 max.	0.50 max.	3.8 to 4.9	0.30 to 0.9	1.2 to 1.8	0.10 max.	0.25 max.	Zr+Ti 0.20 max.	0.15 max.	0.05 max.	0.15 max.	Remainder
2024 Clad plate	Base material	0.50 max.	0.50 max.	3.8 to 4.9	0.30 to 0.9	1.2 to 1.8	0.10 max.	0.25 max.	Zr+Ti 0.20 max.	0.15 max.	0.05 max.	0.15 max.	Remainder
	Skin material (1230)	Si+Fe 0.70 max.		0.10 max.	0.05 max.	0.05 max.	—	0.10 max.	V 0.05 max.	0.03 max.	0.03 max.	—	99.30 min.
3003	—	0.6 max.	0.7 max.	0.05 to 0.20	1.0 to 1.5	—	—	0.10 max.	—	—	0.05 max.	0.15 max.	Remainder
3203	—	0.6 max.	0.7 max.	0.05 max.	1.0 to 1.5	—	—	0.10 max.	—	—	0.05 max.	0.15 max.	Remainder
3004	—	0.30 max.	0.7 max.	0.25 max.	1.0 to 1.5	0.8 to 1.3	—	0.25 max.	—	—	0.05 max.	0.15 max.	Remainder
3104	—	0.6 max.	0.8 max.	0.05 to 0.25	0.8 to 1.4	0.8 to 1.3	—	0.25 max.	Ga 0.05 max., V 0.05 max.	0.10 max.	0.05 max.	0.15 max.	Remainder
3005	—	0.6 max.	0.7 max.	0.30 max.	1.0 to 1.5	0.20 to 0.6	0.10 max.	0.25 max.	—	0.10 max.	0.05 max.	0.15 max.	Remainder

Table 2 (concluded)

Unit : %

Alloy No.	Skin and base material	Si	Fe	Cu	Mn	Mg	Cr	Zn	Zr, Zr+Ti, Ga, V	Ti	Others([1]) Each	Others([1]) Total	Al
3105	—	0.6 max.	0.7 max.	0.30 max.	0.30 to 0.8	0.20 to 0.8	0.20 max.	0.40 max.	—	0.10 max.	0.05 max.	0.15 max.	Remainder
5005	—	0.30 max.	0.7 max.	0.20 max.	0.20 max.	0.50 to 1.1	0.10 max.	0.25 max.	—	—	0.05 max.	0.15 max.	Remainder
5052	—	0.25 max.	0.40 max.	0.10 max.	0.10 max.	2.2 to 2.8	0.15 to 0.35	0.10 max.	—	—	0.05 max.	0.15 max.	Remainder
5652	—	Si+Fe 0.40 max.		0.04 max.	0.01 max.	2.2 to 2.8	0.15 to 0.35	0.10 max.	—	—	0.05 max.	0.15 max.	Remainder
5154	—	0.25 max.	0.40 max.	0.10 max.	0.10 max.	3.1 to 3.9	0.15 to 0.35	0.20 max.	—	0.20 max.	0.05 max.	0.15 max.	Remainder
5254	—	Si+Fe 0.45 max.		0.05 max.	0.01 max.	3.1 to 3.9	0.15 to 0.35	0.20 max.	—	0.05 max.	0.05 max.	0.15 max.	Remainder
5454	—	0.25 max.	0.40 max.	0.10 max.	0.50 to 1.0	2.4 to 3.0	0.05 to 0.20	0.25 max.	—	0.20 max.	0.05 max.	0.15 max.	Remainder
5082	—	0.20 max.	0.35 max.	0.15 max.	0.15 max.	4.0 to 5.0	0.15 max.	0.25 max.	—	0.10 max.	0.05 max.	0.15 max.	Remainder
5182	—	0.20 max.	0.35 max.	0.15 max.	0.20 to 0.50	4.0 to 5.0	0.10 max.	0.25 max.	—	0.10 max.	0.05 max.	0.15 max.	Remainder
5083	—	0.40 max.	0.40 max.	0.10 max.	0.40 to 1.0	4.0 to 4.9	0.05 to 0.25	0.25 max.	—	0.15 max.	0.05 max.	0.15 max.	Remainder
5086	—	0.40 max.	0.50 max.	0.10 max.	0.20 to 0.7	3.5 to 4.5	0.05 to 0.25	0.25 max.	—	0.15 max.	0.05 max.	0.15 max.	Remainder
5N01	—	0.15 max.	0.25 max.	0.20 max.	0.20 max.	0.20 to 0.6	—	0.03 max.	—	—	0.05 max.	0.10 max.	Remainder
6061	—	0.40 to 0.8	0.7 max.	0.15 to 0.40	0.15 max.	0.8 to 1.2	0.04 to 0.35	0.25 max.	—	0.15 max.	0.05 max.	0.15 max.	Remainder
7075	—	0.40 max.	0.50 max.	1.2 to 2.0	0.30 max.	2.1 to 2.9	0.18 to 0.28	5.1 to 6.1	Zr+Ti 0.25 max.	0.20 max.	0.05 max.	0.15 max.	Remainder
7075 Clad plate	Base material	0.40 max.	0.50 max.	1.2 to 2.0	0.30 max.	2.1 to 2.9	0.18 to 0.28	5.1 to 6.1	Zr+Ti 0.25 max.	0.20 max.	0.05 max.	0.15 max.	Remainder
	Skin material (7072)	Si+Fe 0.7 max.		0.10 max.	0.10 max.	0.10 max.	—	0.8 to 1.3	—	—	0.05 max.	0.15 max.	Remainder
7N01		0.30 max.	0.35 max.	0.20 max.	0.20 to 0.7	1.0 to 2.0	0.30 max.	4.0 to 5.0	V 0.10 max., Zr 0.25 max.	0.20 max.	0.05 max.	0.15 max.	Remainder
8021		0.15 max.	1.2 to 1.7	0.05 max.	—	—	—	—	—	—	0.05 max.	0.15 max.	Remainder
8079		0.05 to 0.30	0.7 to 1.3	0.05 max.	—	—	—	0.10 max.	—	—	0.05 max.	0.15 max.	Remainder

Note ([1]) Only when the existence of other elements is presumed or, in the course of routine analysis an indication that the content of other elements will fall outside the specified range, further analysis thereof shall be conducted.

Glossary

n (abbreviation) See nano-.

NAB (organization) Abbreviation for National Association of Broadcasters. For several years, prior to January 1, 1958, it was known as National Association of Radio and Television Broadcasters (NARTB).

nail head bonding (process/IC) A synonym for ball bonding.

NAND gate (circuit) A logic circuit which performs the AND function and then inverts the result. A NOT-AND gate.

See also AND gate, and NOR gate.

nano- (prefix) A prefix meaning 10 -9, which is 0.000000001 or one billionth.

nanosecond (measurement) One billionth of a second.

narrow-band EMI (electrical) EMI generated from a device operating at a specific and limited range of frequencies.

See also EMI.

Natural Rubber (NR-isoprene) (material) Rubber by itself is lacking in many properties required of wire and cable insulating and jacketing materials. However, by proper compounding and mixing with other products, it can be converted to a material with excellent physical properties, good electrical properties, and fair to moderate ozone resistance and chemical resistance.

NBR (abbreviation) See Nitrile-Butadiene Rubber.

NBR/PVC (abbreviation/material) A blend of nitrile rubber and polyvinyl chloride, is recommended for oil and ozone resistant jacketing of flexible cord and fixture wires, cables, and ignition wires. NBR/PVC is said to offer toughness, smoothness, flame resistance, flexibility, and resistance to abrasion and heat deformation, and to give outstanding service when exposed to weather, light, fuel, oil, or ozone.

NC contacts (device/circuit) See NO or NC contacts.

NEC (abbreviation) Abbreviation for National Electric Code.

negative logic (circuit/system) Digital logic is termed negative when logic 0 is assigned the more positive level (ie higher voltage level than logic 1). Logic 1 is assigned the lower (more negative) level. It is the inverse of positive logic.

NEMA (organization) Abbreviation for National Electrical Manufacturers Association.

neon (general) An inert element from Group O of the periodic table of chemical elements. Exists as a gas at normal temperatures and pressures. When ionized by current passing through it, as in neon signs, bulbs, pilot lights, test probes, etc, it produces a bright orange-red glow.

Iron - the second most unusual substance on earth.

written by Michael Harwood

Iron is the second most abundant element in the earth's crust (after aluminum) and it is the element that has had the greatest influence on the earth's history (so far). Unlike aluminum it is really easy to extract from iron ore (just heat it with charcoal and limestone). When pure it is soft and malleable, yet it forms many alloys with all sorts of useful properties. Iron is quite reactive chemically and rapidly corrodes (rusts) in moist air and warm temperatures. [There is probably a benefit to this feature, but the author cannot think of one at present.] Iron has a higher melting point than copper (about 1,535° C compared to 1,083° C) which is why the bronze age occurred before the iron age. Apart from its greater abundance, iron provided a harder and stronger material than the earlier metals.

Because iron is so easy to work with, it can be made into almost any shape. Iron has been used from prehistoric times (before 3000 BC) to make ornaments, weapons and tools. As recorded in Genesis (4:22), Tubal-Cain, the eighth descendant from Adam, was a forger of bronze and iron instruments. In Europe and the Middle East the iron age began around 1200 BC. Where would civilization be today without the plough, axe and saw? History would be quite different without our heritage of iron weapons: swords, cannons, portcullises, rifles, barbed wire, tanks, aircraft carriers. Steel making reached its zenith in the 16th-17th century with Damascus steel used to make the sharpest and most flexible sword blades. Their manufacture is now a lost art.

Nowadays, we use 20 times more iron (mostly in various forms of steel) than all the other metals put together. Iron is also the cheapest metal. Iron has been crucial in almost every part of the transportation industry: from horseshoes, and iron rimmed wagon wheels, to bridges, trains (iron horses), railroads, cars and ocean liners.

One of the most unusual properties of steel is that it expands at the same rate as concrete. Is this accident or design? This allows us to use steel bars in reinforced concrete to build large and multistory buildings. Concrete is strong in compression but weak in tension. Reinforcement allows for less concrete to be used because the steel carries all the tension; also, the concrete protects the steel from corrosion. Without iron all big structures would need a large number of pillars - like Greek temples or the Roman aqueduct at Nîmes.

Aside from construction and tools, the most important use of iron depends on its very unusual magnetic properties. Each iron atom acts like a small magnet, yet instead of cancelling each other out, there is a long range ordering effect that cannot be explained by normal physics, only by quantum physics. The fact that iron is magnetic was essential to the exploration and mapping of the world. Not only are compasses useful for orienteering in Algonquin park, but their invention allowed transoceanic trade routes with the consequent economic growth and foundation of our country. The most important use of magnets today is in electric motors and generators. Much of our heavy industry is dependant on these things. If iron were not ferromagnetic, you would have no alternator to recharge your car battery, no iron to make electromagnets in buzzers, doorbells, scrapyards, no magnets in loudspeakers, no power tools. Without the magnetic properties of iron, we would only have electricity from batteries!

We also need iron to survive. The 4.5 g in our bodies is essential for haemoglobin to transport oxygen to our cells.

I will end this article by looking at a more technical aspect yet still amazing property of iron: some

of its many useful and unique alloys. Iron forms literally thousands of alloys. (See http://www.principalmetals.com/properties/step1.asp) Solid metal can be hammered, rolled, heated, chilled, given acid or electrochemical baths. Each of these leads to a slight change in the crystalline structure.

Pure iron is a soft, ductile, gray-white metal of high tensile strength that has few uses. Cast iron (containing up to 5% carbon) was the first alloy to be used widely. It is poured from a smelter into moulds made in damp sand or other materials. Because cast iron expands slightly when cooling(!) it keeps it shape well and can be economically cast into complex shapes where strength is not the primary concern. It is hard, but brittle and used for large heavy objects like engine blocks, crankshafts, wood stoves. Wrought iron has less than 0.2% carbon, but about 2% slag . It is as strong in compression as cast iron, but it has much greater tensile strength. It is used for ornaments and tools made by blacksmiths.

Steel is an even further refinement of iron containing less than 1% carbon, and small amounts of various other elements to create special properties. Stainless steel (containing 11% chromium) doesn't rust and is used for items like surgical instruments. Nichrome steel has a high resistance to electricity and is used in toasters and electric heaters. Tool steel is extremely hard and is used for cutting tools and drill bits. Spring steel is very flexible and has a 'memory' which causes it to return to its original shape when released.

After over 5000 years we still depend on the tried and true properties of this unusual material while continually researching new alloys and compounds. A true miracle material!! Who could have designed something with all of these properties?!

P.S. Can you figure out why there are no steel coins?

Nickel and its alloys

Engineers and architects are increasingly designing structures and products that satisfy society's demand for durability, hygiene, energy efficiency, recycleability and sustainability. Life cycle assessments and reliable data on recycle rates for various competing materials have become an integral part of today's design process no matter what industry you consider. Materials that deliver superior economic and environmental qualities, by definition will not diminish the ability of future generations to satisfy their needs. Therefore these materials stand out as a sustainable choice.

Nickel, long used as an alloying element in thousands of alloys, is produced by a wide range of companies world-wide. It has an excellent track record for providing corrosion resistance, high strength at high temperatures and aesthetic beauty in a wide range of applications. Nickel alloys are used today to provide cleaner and safer transportation, clean food and water, reducing emissions to air and water, more durable products, clean and renewable energy, and efficient shipping and communications. It has become known as an "enviro-metal".

To keep you informed of the unique qualities that nickel and its alloys brings to society, Stainless Steel World is working together with the Nickel Development Institute (NiDI) to bring you the wealth of knowledge that appears on this web site. Additional information and resources can be found at the NiDI web site. Any feedback on these nickel webpages will be highly appreciated. Please send your comments or queries using our comments form.

The following articles offer an introduction to selection criteria, data, properties and application of nickel base alloys and high performance stainless steels. Eighteen more NiDI technical papers can be found by checking the sections via the left-hand menu.

Please note: all papers require that you have Adobe Acrobat reader 5.x or higher installed on your system. You can download the Reader for free at Adobe's website.

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